IN THE SPECIFICATION:

The following paragraphs replace the previous versions thereof in this application.

Paragraph beginning on page 1, line 8:

The invention generally relates to the field of substrates or structures for producing electronic components, and to methods of producing such structures. It is applicable to semiconductor structures, in particular silicon on insulator (SOI) type structures. The invention also pertains to techniques for assembling layers or substrates on a substrate of a material having ~~a typical~~ atypical surface properties.

Paragraphs beginning on page 2, line 4:

Furthermore, known techniques for assembling materials do not allow bonding of substrates or layers having an ~~a typical~~ atypical surface that has a roughness of more than a certain limiting value on the order of 0.5 nm root mean square (rms), or which are difficult to polish, or which have a chemical composition that is not conducive to molecular bonding. Occasionally a need arises to bond materials that have a roughness above the limiting value, or wherein at least one of the materials is difficult to polish or has a chemical composition that is not conducive to bonding by molecular bonding, or to bond such a material with a layer or substrate of a material that may itself be compatible with direct bonding or molecular bonding.

Presented is a semiconductor structure that includes a substrate having a surface and being made of a material that provides ~~a typical~~ atypical surface properties to the surface, a bonding layer on the surface of the substrate, and a further layer molecularly bonded to the bonding layer. The ~~a typical~~ atypical surface properties preferably is at least one of a roughness of more than 0.5 nm rms, or a roughness of at least 0.4 nm rms that is difficult to polish, or a chemical composition that is incompatible with molecular bonding.

In an advantageous implementation, the substrate has a thermal conductivity of more than 1 W/cm/K, and may be made of diamond or aluminum nitride material. An intermediate layer to provide the surface layer having the ~~a typical~~ atypical properties layer may be provided before forming the bonding layer. The intermediate layer preferably has a thermal conductivity coefficient that is higher than that of the substrate or that is between that of the bonding layer and that of the substrate. The intermediate layer may be made of silicon nitride.

Paragraphs beginning on page 3, line 8:

In yet another implementation, the further layer is a second substrate of a material having ~~a typical~~ atypical surface properties. The ~~a typical~~ atypical surface properties of the second substrate may include at least one of a roughness of more than 0.5 nm rms, or a roughness of at least 0.4 nm rms that is difficult to polish, or a chemical composition that is incompatible with molecular bonding.

A further aspect of the invention pertains to a method for fabricating such a semiconductor structure. The technique includes providing a substrate having a surface and being made of a material that provides ~~a typical~~ atypical surface properties to the surface, providing a bonding layer on the surface of the substrate, smoothing the bonding layer to provide a surface that is capable of molecular bonding, and molecularly bonding a further layer to the bonding layer to form the structure. Again, the ~~a typical~~ atypical surface properties preferably comprise at least one of a roughness of more than 0.5 nm rms, or a roughness of at least 0.4 nm rms that is difficult to polish, or a chemical composition that is incompatible with molecular bonding.

In an advantageous implementation, the method includes forming an intermediate layer on the substrate to provide the surface layer having the ~~a typical~~ atypical properties before providing the bonding layer, the intermediate layer having a thermal conductivity coefficient that is higher than that of the substrate or that is between that of the bonding layer and that of the substrate. The intermediate layer may be composed of silicon nitride.

Paragraph beginning on page 4, line 1:

In another advantageous embodiment, the further layer is a second substrate of a material having ~~a typical~~ atypical surface properties. The method may further include providing a second bonding layer on the second substrate before molecularly bonding, and the second substrate may be made of at least one of diamond or aluminum nitride.

Paragraphs beginning on page 5, line 1:

Figure 2 shows a first example of a structure in accordance with the invention. Figure 2 depicts a substrate 10 having ~~a typical~~ atypical surface properties. The term "~~a typical~~ atypical surface properties" means surface properties of an untreated surface that would prevent or interfere with molecular bonding of that surface to another component. The substrate 10 is preferably formed from an electrically insulating material. The substrate 10

includes a layer 14 formed from a semiconductor material such as silicon or germanium (Ge) or gallium arsenide (GaAs) or silicon-germanium (SiGe) or Group III-Group V semiconductor components or Group II-Group VI semiconductor components, and a bonding layer 12 located between the substrate 10 and the layer 14. The layer 14 may be another substrate in another embodiment. The substrate 10 may also be a substrate having a rough surface 15, and can, for example, be in the range of about 100 micrometers (μm) to about 2 millimeters (mm) thick.

The surface 15 having ~~a typical~~ atypical surface properties may have a roughness of more than 0.4 nm rms or 0.5 nm rms. For practical reasons, molecular bonding cannot be carried out, or is very difficult to carry out, on a substrate or a layer having such a rough surface (see in particular Q. Y. Tong and U. Gosele, Semiconductor Molecular bonding: Science and Technology, Wiley-Interscience, p 86, 1999). The ~~a typical~~ atypical surface properties of the substrate can also be a chemical composition that does not accept molecular bonding or that provides chemical properties that are incompatible with molecular bonding. The substrate 10 can also be formed from a material that is difficult to polish, i.e., wherein a surface roughness of less than 0.4 nm rms or 0.5 nm rms can only be obtained after polishing for a very long period. These are additional examples of ~~a typical~~ atypical surface properties. In practice, such a material cannot be used because it would be too expensive to treat or polish it to obtain a suitable bonding surface roughness of less than 0.4 nm rms or 0.5 nm rms.

Paragraph beginning on page 6, line 17:

A layer or base layer, itself on a substrate, can also be used in place of the substrate 10. The base layer can then have a thickness of several tens of nm, for example, in the range of about 50 nm to about 300 nm. The material for the base layer has the same properties as those described above in the case of a substrate, that is the base layer material has an ~~a typical~~ atypical surface that is difficult to polish, or has a roughness of more than 0.4 nm rms or 0.5 nm rms, or has a surface with a chemical composition that is incompatible with or which will not accept molecular bonding, or wherein the chemical properties are incompatible with molecular bonding.

Paragraph beginning on page 9, line 25:

A further implementation of the invention is shown in Figure 6. In this variation, a substrate 40 (which could also be a layer) with ~~a typical~~ atypical surface properties, e.g., high

roughness (more than 0.4 nm rms or 0.5 nm rms, for example, in the range of about 1 nm rms to about 100 nm rms), or which is difficult to polish or has a chemical composition that is incompatible with bonding by molecular bonding, is treated so that it can be bonded to another substrate 50 (which may be a layer) with the same properties. For example, the substrate 40 is formed from diamond while the substrate 50 is formed from diamond or AlN (aluminum nitride).

Paragraph beginning on page 10, line 11:

As illustrated in Figure 7, the method generally applies to connecting a substrate 40 (or a layer) having an ~~a typical~~ atypical surface to a substrate 60 (or a layer) with a chemical composition and roughness that are compatible with bonding by molecular bonding, wherein the roughness of the substrate 60 is below about 0.5 nm rms. That is, the substrate 40 is difficult to polish to or has very high roughness, and is in any case has a roughness of more than 0.5 nm rms, for example in the range of about 1 nm rms to about 100 nm rms, or has a chemical composition that is incompatible with bonding by molecular bonding. A bonding layer 42 is formed on the substrate 40, directly or with an intermediate layer as explained above. The bonding layer is silicon dioxide, for example. It is then possible to establish a bond by molecular bonding between this bonding layer and the substrate 60. The foregoing description also applies if the layer of silicon or semiconductor material is replaced by the layer or the substrate 60. In the last two cases, the material of each substrate that is difficult to polish or has roughness of more than about 0.5 nm rms or has chemical composition that is incompatible with bonding by molecular bonding, can be selected from the materials mentioned above, for example, diamond or aluminum nitride (AlN).